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A STUDY OF SOIL EROSION AND SEDIMENT PRODUCTION RATES ON SELECTED FORESTRY OPERATIONS IN NORTH CAROLINA

by

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Abstract

The objectives of this study were to expand, improve, and analyze certain data regarding forestry practices in North Carolina to aid the State Division of Forest Resources in planning, training, improving, and conducting forest operations in light of present and future environmental concerns. The primary objective was to generate erosion information on forestry operations. A modified Musgrave soil erosion equation was used to evaluate all 18 sites reported as having excessive erosion in a 1974 study by the Division of Forest Resources. Also 15 sites reported with water course damage and 38 nonimpact areas were re-examined. The harvesting sites were found to have the highest production rates for both sheet erosion and sheet sediment. Sheet erosion was found to range from over 99 tons/acre/year for skid trails and from 35 to 59 T/A/Y for site preparation practices. The latter is equivalent to an average of .25 to .38 inch loss of soil per acre respectively.

This study was conducted through the 1975 State Government Summer Intern Program by the N. C. Division of Forest Resources, Department of Natural & Economic Resources. James B. Kea is a graduate student in Urban Forestry at N. C. State University. He has a B.S. in Forest Management and a B. S. in Natural Resources Recreation Management. Technical assistance in preparing the erosion field forms was provided by George E. Dissmeyer, Hydrologist, State & Private Forestry, U. S. Forest Service, Atlanta, Georgia. The erosion data was processed by the U. S. Forest Service computer program at Fort Collins, Colorado.

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INTRODUCTION

In August 1974, the Division of Forest Resources conducted a statewide survey to evaluate the present status of forest practices and their short term impact on the forest resources and environment. The Department's foresters inspected and evaluated over 700 recent forestry operations in every county of the state. The results of this study were presented in December 1974 in a report, "A Study of Harvesting and Cultural Impacts in North Carolina."

Excessive damage to soil, water and aesthetic impacts was found in only 5% of the operations inspected in 1974. The purpose of the 1975 study was to quantify the amount of the erosion and qualify the degree of water course damage which had occurred on these sites. It was also to make a representative sample of those areas which had been classified as nonimpact areas to determine if any change in conditions had taken place.

The 1974 study indicated that harvesting operations showed somewhat more serious erosion and soil compaction problems than the site preparation operations. There was an adverse impact on the water resources in less than 30% of the harvesting operations with only 4% of these cases being severe. Logging debris in the stream was the principal cause of this problem. Cultural operations showed only half of this frequency of adverse water quality impacts.

SAMPLING OF SITES

In order to estimate the erosion and sediment production rate, it was necessary to employ a system that would call for simple measurements and not require periodic sampling of an established plot. George Dissmeyer of the U. S. Forest Service has developed a system employing a modified Musgrave equation for soil erosion which meets these criteria. Data collection forms allowed sheet erosion, sheet sediment, gully erosion, gully sediment, weighted erosion rates, and weighted sediment rates to be estimated for each plot by a special computer program. Because of the number of categories involved in the data collection and the relatively small number of sample plots, false conclusions could result from interpretation of data. 1/

The field form was originally designed to survey watershed basins, but it was slightly modified to sample disturbances on these selected sites. Each site sampled was designated by the 1974 study, or it was a nonimpact site that had been designated in this study for a spot check.

To obtain representative plots without requiring extensive random sampling, plots were chosen which appeared to be representative of the area. Random samples, however, were taken in some fairly homogenous areas. Normally a transect running with a contour was followed with three or more 1/4 acre plots being taken at 200 foot plot centers.

Data was also collected for the computer program data sheet on gully erosion. Sheet erosion was computed by the modified Musgrave equation:

$$E = K\ C\ R \left(\frac{S}{10}\right)^{1.35} \left(\frac{L}{72.6}\right)^{0.35}$$

E = Sheet erosion, tons per acre per year

K = Erosion rate of soil series, in tons per acre per year per unit of rainfall index

C = Cover factor

R = Rainfall factor

S = Land slope in percent

L = Length of slope in feet

Data for computation of the "K" factor was based on the on-site soil characteristics rather than the mapped soil series. These characteristics greatly influence runoff and infiltration as identified by runoff curve numbers on the computer printout. Basically surface soil texture, depth of soil to parent material, hydrologic soil group (inherent infiltration characteristics of sand, clay, and silt soils), vegetative type (humus characteristics), humus depth, and the degree of soil compaction measurements or observation go into determining the "K" factor.

1/ This section is basically a summary of information found in the "Field Form for Hydrologic Surveys and Analyses Instructions" compiled by the Resource and Management Unit, Southeastern Area Forest Service, U. S. Department of Agriculture used to collect the sample data for this study.

The "C" or cover factor is an estimate of the percent of the plot that was bare ground. Rock cover, erosion pavement and rock out crops were not considered as bare ground. Erosion pavement consists of small rocks which can virtually pave an area and protect it from the abrasive force generated by raindrop impact. By using a 10 by 10 foot block as one percent of the plot, the estimates were fairly accurate.

The "R" or rainfall factor was determined from values assigned for each county.

Slope, length of slope, and aspect were determined for each plot.

Erosion included both gully and sheet erosion. Gullies found on the plots were measured to determine their cross-sectional area and length. The approximate age of the gullies was also recorded to yield an average yearly erosion rate.

Although the sheet and gully erosion figures can be used to produce a total erosion rate, only the sheet erosion rate was converted to a sedimentation rate on the sites that did not include gully erosion by use of on-site observations and the textural soil triangle. Basically the percent of sedimentation produced can be estimated by the changes in sand, silt, and clay components of the on-site soil. Any settling or filtering of one of these components may be found between the plot and stream thus regulating part of the loss. It is well to remember that some fine clay particles require more than a vegetative filter strip to prevent their introduction into a stream. Gully erosion figures were used only to convert into a straight sedimentation rate.

A total of 71 sites, located in 33 counties, were re-inspected. The 1974 study data sheets indicated that 47 of these were harvesting impact sites and 24 were cultural impact sites. However, re-examinations revealed that cultural activities had been carried out on 8 of the harvesting sites, decreasing the new total to 39 harvesting impact sites and increasing from 24 to 32 the number of cultural impact sites. Of the 71 sites examined, 11 had excessive water course damage(15%), 14 had excessive soil erosion (19%), and 4 had both excessive water course damage and soil erosion (5%). Therefore, 18 excessive erosion sites and 15 excessive water course damage sites were sampled and evaluated. They comprised all of the sites found in these categories of the original 700+ sites that were inspected in 1974. All of the excessive erosion sites were located in the piedmont and mountain counties.

ANALYSIS OF DATA

Analysis of the computer printouts was made with the assistance of George Dissmeyer. He processed the field data sheets by means of a hydrologic survey analysis computer program developed by the U. S. Forest Service.

Descriptive Data by Individual Sites

A summary showing the location, time since disturbance, the type of disturbance, and a description of the condition for each site re-inspected is found in Appendix A. Sites are grouped into excessive erosion, water course damage and nonimpact sites. A key to the abbreviations used in this summary is found on Page 8 of Appendix A.

Changes in Site Classifications

Several sites were found to have different classifications upon being re-examined approximately one year later. Some of these changes were due to observer bias or interpretation when first inspected.

Most of the questions on the initial field form had a great deal of latitude for the bias that emerged. Many sites classified as clearcuts were actually high graded. General conditions throughout a region seemed to influence the interpretation of erosion damage. Values were relative rather than objective, and variation in aesthetic judgment is always present. Questions involving the landowner's attitude toward biological factors were impossible to answer because personal contact was not made with them. Other categories were fairly objective in nature and did not allow for bias, only for error.

Two areas classified as nonimpact sites were found to have changed to excessive erosion sites. One area with soil erosion and water course damage was reclassified as having only water course damage. Five excessive erosion sites, four excessive water course damage sites, and one site with both water course damage and excessive erosion were downgraded to nonimpact sites for various reasons: One area had become a home site; several multi-use areas had problems related to other on-site uses such as grazing, trail bikes and farm roads; several sites were subject to run-off from adjacent land, resulting in sedimentation or erosion that would not have otherwise been a problem; two water course damage sites had been ditched; and a partial conversion was made to a home garden on an erosion site.

PRODUCTION RATES ON EXCESSIVE EROSION SITES

Table 1 shows the amounts of sheet erosion and sheet sediment in tons per acre per year. These amounts have occurred since the operations were carried out for each of the logging and cultural practices. This data has also been used to compute the average depth of soil which was removed from the site. This was done to provide a frame of visual reference as to the amount of soil displaced per acre. Tons per acre is difficult to visualize and relate to the soil displacement for the areas and practices.

Another frame of reference helpful to the reader in comparing the soil losses in Table 1 is to compare them with sites on forests which have not been disturbed for a period of five years. Recent investigations on river basins indicate that the largest amount reported for such sites is 0.15T/A/Y (300 pounds). 2/ Practically all of this amount is from the downcutting of the stream channel; very little or no soil is lost from such undisturbed sites.

2/ Personal communication from James E. Douglass, Project Leader, Coweeta Hydrologic Laboratory, U. S. Forest Service.

Table 1. Amounts of Sheet Erosion & Sheet Sediment Deposited in Water Courses (Tons per Acre per Year) 3/

Forestry Operation	Sheet Erosion	Ave. Inches of Soil Erosion on One Acre	Sheet Sediment Deposited in Water Course
Skid trails	99+	.64	36+
V-bladed - shaped beds	59	.38	0.5-
KG and pile	42+	.27	13+
Straight blading and pile	35+	.23	4+
Spur Roads	35+	.23	8+
Logging Deck	28+	.15	4+
General logging	8	.05	0.3

The results shown in Table 1 are discussed below for each type of operation:

Skid trails - Most of the problem sites had improper skid trail layout and ineffective or no skid trail stabilization (6 cases of stabilization and 5 improper layouts--some mutually inclusive). Sheet erosion on skid trails averaged 99+ tons per acre of skid trail per year after two to three years. The average sheet sediment value was found to be 36+ T/A/Y. These were found to be the highest rates for sheet erosion and sheet sediment.

V-Blading - A V-blade was used to shape beds on two excessive erosion sites. They produced an average of 59 T/A/Y of sheet erosion after three to four years. However, less than 0.5 T/A/Y resulted in sheet sediment. Erosion resulted mainly because the operators failed to follow contours. This practice ranked highest for the site preparation methods and second to skid trails.

KG and Pile - This practice ranked third in sheet erosion production at 42+ T/A/Y, with an average sheet sediment production of 13+ T/A/Y. Again, contours were not followed. Some areas had excessive soil disturbance by gouging with the blade or from turning the tractor.

Straight Blading and Spur Roads Piling - Both of these operations produced an average of 35+ T/A/Y of sheet erosion. Sheet sediment from spur roads averaged 8+ T/A/Y, whereas that from straight blading and piling averaged about 4+ T/A/Y. Straight blading by an untrained operator on one job was better than on other similar jobs by experienced operators. Because it is easier to push with contours, experienced operators generally do so. Piling was spaced at wide intervals apparently to provide more available area for planting trees. Ironically, wide spacing on long slopes results in higher erosion and lost productivity, because pushing over longer distances increases gouging by the debris. Furthermore, piling the debris diagonally on slopes apparently can be done with about the same work as on the contours. This technique can eliminate the concentration of water that occurs when piling contours.

3/ Does not include gully erosion figures

Many of the spur roads were still used as farm roads, and all roads had a tendency to concentrate runoff. Proper layout and the use of water bars would control much of the erosion.

Logging Deck - One deck was sampled and it was found to produce 28+ T/A/Y of sheet erosion. Most decks were well covered with bark and debris thereby preventing erosion. Decks are usually located on high ground; therefore, soil compaction and the resulting runoff tend to increase erosion down slope.

General Logging - Logging disturbances produced about 8 T/A/Y of sheet erosion and only 0.3 T/A/Y of sheet sediment. General logging disturbances usually had a rapid recovery rate to 100% ground cover. Sites that had apparently been understocked when cut had a high density vine cover within one year; whereas, relatively clear sites had recovery times up to about three years.

Logging disturbances involving compacted sites or rocky soil usually required longer than five years to recover. Only vine growth was found on highly compacted or rocky soils. A rocky soil in Caswell County supported little grass after seeding. In fact, gullies existed on grassed roads with water bars installed at 50 foot intervals. Vine cover or a running grass such as centipede or Saint Augustine grass may be the only practical solution in such cases.

EFFECTS OF EROSION AND SEDIMENT ON STREAMS AND SITES

Erosion Effect on Water Quality

Another objective of this study was to develop a basis for future work in evaluating the environmental impacts of forest practices in some quantitative way. In this respect some confusion exists as to how water quality can best be measured. Turbidity, the optical quality of water, is easily measured and easily related to aesthetics. The weighted sediment rate was computed in tons per acre per year (T/A/Y). Conversion to mg/liter or parts per million can be accomplished by use of area stream flow data and the T/A/Y from the computer printout. EPA will shortly release turbidity standards based on mg/l.

Erosion Effect on Site Productivity

Productivity and profit seem to provide more potential in initiating erosion control practices than water quality standards. Water quality involves somebody downstream whereas productivity and profit hit home. Because productivity depends on the soil, some relation exists between soil loss and loss in productivity. Work by Coile in predicting yields by soil depth is probably applicable here. Although measurements taken for this study cannot be used in the Coile method, a slight modification in sampling procedure could satisfy both systems. The SCS has developed T-factors for agricultural lands, and similar factors could be developed for forest land. The T-factor is the amount of soil a site can lose in T/A/Y without a reduction in soil fertility. Agricultural T-factors range from one to five T/A/Y. Further research in productivity loss on forest land would be very useful.

Water Course Damage Caused by Logging Equipment

In addition to the damage produced by the sedimentation to streams, stream damage caused by debris and equipment was also observed. Several sites had stream crossings that greatly diffused stream flow into rubber-tired skidder ruts. In many cases these ruts served as sediment basins for runoff that followed the skid trail. This was particularly true in areas where streams drained swampy areas. Most of these areas were well grassed, and the only apparent damage was compaction. There were some areas where skidding occurred in the stream bed or where there was fill, including sawdust, pushed into the stream with logs used to make an open culvert.

Slash in water courses was fairly common, but it did not cause a great deal of blockage. None of the areas had debris piled in stream beds. There were tops and small trees across many streams, but only a small number were actually in the water. Several sites had dense honeysuckle covering the slash left near streams and it shaded the water.

COOPERATIVE NON-POINT SOURCE POLLUTION STUDY

The N. C. Division of Forest Resources and the U. S. Forest Service Coweeta Hydrologic Laboratory, through a cooperative agreement, will start installation of a three year non-point source pollution study in October 1975. The objectives of this study are to quantify erosion runoff and nutrient losses from alternative mechanical site methods applied in Piedmont North Carolina. The erosion and nutrient losses will be actually measured, and a key objective of the study will be to establish the error term associated with erosion estimates such as used in this study. This is a parameter which is unavailable but is badly needed in the evaluation of erosion results. The range in observed runoff and erosion from various treatments will also provide previously unavailable information. Also the time trends of site recovery for the first three years after treatment will be determined. This study will provide needed basic data for EPA to set realistic allowable water quality standards for forestry site preparation operations.

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APPENDIX A

Excessive Erosion Site Summaries

Seq. No.	County	BSP	Region	Time Since Disturbance	Disturbance
9801	McDowell	50-24-13	III	4 yrs.	K T P P1

Used straight blade to pile. Blackberry cover. Windrows up and down slope. Erosion also on old sawmill site and access road. Soil - sandy loam to sand.

9802	Rutherford	76-7-2	III	2 yrs.	H

Skid trails concentrate water. Water bars and cover crop would have helped. Stream on site. Soil - clay.

9803	Buncombe	67-16-12	III	3 yrs.	H

Skid trails not stabilized after use. Highest sheet erosion rate 587.291 T/A/Y. Steep slopes 40%+. Skid trails 20%. Soil - rocky clay.

9804	Caldwell	6-19-15	III	3 yrs.	KG P P1

KG and piled up and down slope. Vegetative cover thick in areas (honeysuckle, blackberry, poison ivy, greenbriar). Excessive soil in windrows indicates improper use of KG blade. Division of Forest Resources work. Soil - clay.

9805	Halifax	110-11-1	II	2 yrs.	T P P1

Windrows up and down slope. Excessive soil in windrows indicates improper use of straight blade. Grass cover. Soil - clay.

9806	Hoke	8-9-18	II	2 yrs.	H

Fine sandhills sand exposed by logging. Area leased for hunting. Roads are all bare sand. Very slight erosion. Some movement probably due to wind erosion. Soil - sand.

9807	Cumberland	110-13-5	II	3 yrs.	V P1

Runoff from spur road system still in use, and beds up and down slope have resulted in one area of erosion. Soil - sand. Division of Forest Resources work.

9808	Cumberland	110-13-22	II	4 yrs.	V DS

V blade up and down slope. Weyerhaeuser. Soil - sand.

9809	Cumberland	111-16-10	II	2 yrs.	H

No observable slope; therefore, no erosion off-site. Some pedestal formation. Skidding and debris in stream. Classified as water course damage. Soil - sandy clay.

Seq. No.	County	BSP	Region	Time Since Disturbance	Disturbance
9810	Transylvania	100-20-15	III	2 yrs.	H

Skid trail in water course for about 100 feet. Trails lead to creek. Trails not stabilized or layed out properly. Steep slopes (40%+). Classified as water course damage. Soil - clay.

9811	Surry	87-17-7	II	2 yrs.	T P P1

Soil exposed by straight blade. Windrows on contour. "Untrained equipment operator." Heavy sprout and blackberry growth. Soil - clay loam.

9812	Rowan	70-19-13	II	3 yrs.	T P B P1

Very shallow soil. Steep slopes disturbed by straight blade in piling. Moderate cover of grass and blackberry. Site overprepared. Alcoa land. Soil - rock clay.

9813	Davidson	34-16-18	II	2 yrs.	H

Skid trails up and down slopes not stabilized. Logged wet. High grade. Soil - clay.

9814	Yadkin	113-11-25	II	2 yrs.	H

High grade. Road through stream and up and down slope. Skid trails stabilized by weeds. Logging deck relatively flat and covered with slabs and sawdust. Classified as water course damage. Soil - clay.

9815	Forsyth	143-6-16	II	1 yr.+	H

Excessive debris and undergrowth. High grade. Area cut up until a year ago, using two portable sawmill sites. Most of area is stabilized by undergrowth, slash, and residual trees. Skid trails have some grass cover. Soil - sandy loam.

9816	Caswell	93-4-23	II	2 yrs.	H

Thinning for Wildlife Resources Commission. Area previously eroded as evidenced by deep inactive gullies. Skid trails up and down slope. Stabilization of skid trails partially successful. Gullies have formed between water bars. Soil - sand.

9817	Caswell	81-3-20	II	2 yrs.	H

Soil exposed during logging. Skid trails up and down slope. Skid trails not stabilized. Skid trail through creek (some blockage). Sawdust in stream classified as water course damage. Soil - clay loam.

Seq. No.	County	BSP	Region	Time Since Disturbance	Disturbance
9818	Iredell	14-24-21	III	2 yrs.	H

High graded. Soil exposed during logging. Erosion accelerated by runoff from field. Skid trail up and down slope. Soil - clay loam.

Water Course and Nonimpact Site Summaries

1	Buncombe	52-19-9	III	3 yrs	K P P1

Area is well healed except for one or two spots in old road. Slash piles are barely visible. Area is well stocked but has a moderate amount of hardwood sprouts.

2	Buncombe	68-10-17	III	4 yrs.	H

Area has a lot of hardwood sprouts as well as residual hardwoods. Erosion appears to have been a problem after harvesting. Some erosion is present on old skid trails. State maintained road is causing some erosion across lower part of site. Soil is very rocky. Slope is very steep.

3	Buncombe	65-18-3	III	3 yrs.	H

Area was cut as a result of Southern pine beetle attack. Logger high graded the site, leaving a lot of slash and cull trees. Utilization has been improved with the reduction of slash and some cull trees to firewood. Erosion is not a problem. Area is covered in vines. Very few pine seedlings could be found.

4	Mitchell	143-13-15	III	6 yrs.	K P1

Well established white pine.

5	Mitchell	142-23-3	III	2 yrs.	H

Converted to a home site.

6	Burke	29-16-6	III	2 yrs.	H

Area is very hilly. Logging roads have some erosion but have weed cover. High graded. Adjacent to Catawba River.

7	Burke	38-5-20	III	2 yrs.	H

Cut involved only Southern pine beetle killed trees adjacent to Lake James. Skid trails being used by campers to reach clearings created by removed trees. Small areas involved.

8	Caldwell	5-7-10	III	0	K P P1

Work is in progress. Old roads stablized with grass. Roads now being used have water bars. KG and pile up and down slope will present an erosion problem. Evidence of sediment in streams. Erosion measurements not taken.

Seq. No.	County	BSP	Region	Time Since Disturbance	Disturbance
9	Caldwell	31-7-20	III	4 yrs.	H
	Area is used as a side yard for mobile home.				
10	Caldwell	139-21-3	III	3 yrs.	H
	High graded. Residual trees have closed canopy. Erosion on woods road is slight.				
11	Johnston	45-7-17	II	1 yr.	T P P1
	Rubber-tired skidder tracks in low wet area have changed the flow pattern of a drainage. Sedge grass has covered the drainage. The rest of the area has been straight bladed and piled on the contour. Slight erosion has resulted between some rows. Yellow poplar seedlings in evidence, especially along drainage.				
12	Johnston	58-22-2	II	2 yrs.	H
	Area is swampy most of the year. Sedge grass is over waist-high in logging roads. Stream banks and stream overgrown with brush. Debris in and around stream is moderate. Classified as water course damage.				
13	Johnston	45-9-6	II	3 yrs.	K P P1
	Area has intense hardwood sprout growth. Planted pine still doing well.				
14	Johnston	56-10-4	II	2 yrs.	H
	High grade. A lot of pulpwood and snags left. Runoff from field flows down skid trail and into stream. Stream has been damaged by both skid trail and debris. Classified as water course damage.				
15	Cumberland	2-4-10	II	2 yrs.	H
	High graded. Beautiful area before cut. Logged when wet. Natural reproduction in open areas. Good weed cover.				
16	Robeson	60-21-4	II	2 yrs.	H
	Area completely healed. Sedge grass waist-high in roads. Part of area fenced off with barbed wire. Natural regeneration from sprouts and seedlings along with residual saplings forms a thick underbrush. Water course has been cleared with a dragline. Spoil banks are well vegetated.				
17	Harnett	86-20-13	II	2 yrs.	H
	Only a very small area was cut. A boom truck is still on the site along with some good sawlogs. Area is swampy.				

Seq. No.	County	BSP	Region	Time Since Disturbance	Disturbance
18	Harnett	106-15-13	II	3 yrs	B C & K P P1
	Part of area was burned and chopped, and part was KG-bladed and piled. Some erosion on access road which is also a farm road. Area is well vegetated.				
19	Harnett	86-7-2	II	4 yrs.	H
	High grade. Sediment deposited on site from road ditch. Area is well vegetated.				
20	Franklin	118-23-5	II	3 yrs.	B C P1
	Area heavily vegetated. Some spots of erosion. Deep ditch in center of area contains some slash but no blockage.				
21	Franklin	118-5-20	II	2 yrs.	T P B P1
	Area is well vegetated with planted pine as well as hardwood sprouts. Some stumps piled within a few feet of a stream could produce some sediment. Area where skid trail crosses creek is well grassed with only slight evidence of erosion. Classified as water course damage.				
22	Halifax	100-13-12	II	1 yr.	K P P1
	Area adjacent to Interstate 95. KG on contour. Soil in windrows is excessive in spots.				
23	Halifax	102-6-17	II	4 yrs.	C P
	Area well vegetated. No problems.				
24	Wilson	48-2-24	II	2 yrs.	H
	Area is part of a pasture. Ditch has been cleaned out.				
25	Nash	14-14-8	II	4 yrs.	H
	High graded. Area well vegetated.				
26	Nash	123-25-17	II	2 yrs.	H
	Area is in a swampy creek bottom. High graded. Residual trees are fair growing stock.				
27	Edgecombe	137-25-17	II	3 yrs.	T P P1
	Intense hardwood sprout competition. Some large residual oaks.				
28	Bertie	119-15-1	I	2 yrs.	K B P
	Well vegetated. Erosion problem on access road.				

Seq. No.	County	BSP	Region	Time Since Disturbance	Disturbance
29	Bertie	120-16-13	I	2 yrs.	K B P Bd F P
	Area has good grass cover.				
30	Bertie	135-12-11	I	2 yrs.	K P P1
	Needs to be replanted in spots. Debris not piled well.				
31	Bertie	12-10-25	I	1 yr.	T P P1
	To be aerial seeded. Very little competition exists.				
32	Martin	35-12-8	I	2 yrs.	H
	Not logged. Hand-seeded. High graded. Drainage problem due to skid trails.				
33	Martin	47-4-1	I	3 yrs.	K P1
	Many large stumps remain. Intense sprout competition. Debris heavy but flat on ground.				
34	Martin	37-22-8	I	1 yr.	K P P1
	Georgia Pacific land. Well vegetated. Well drained.				
35	Martin	25-6-2	I	2 yrs.	K P B Bd F P1
	Off U.S. 64. Identification sign for public relations. Weyerhaeuser.				
36	Columbus	74-17-3	I	3 yrs.	H
	Area is in a swamp. A great deal of soil disturbance occurred. Runoff and sediment from adjacent field are diverted into area. Tall grasses and slash have filtered sand out of the runoff. Water is high in organic matter. Some trees were pushed down to eliminate shading of the field. Classified as water course damage.				
37	Duplin	27-25-7	I	2 yrs.	K P B P1
	Area well vegetated. Windrows could have been burned. Most are very high. Weyerhaeuser Company land.				
38	Columbus	89-13-2	I	2 yrs.	C V Bd P1
	Area has a great deal of soil disturbance with very little accomplished. Some soil has been removed. Erosion is confined to county road banks.				
39	Brunswick	132-14-13	I	2 yrs.	K B
	Area not planted yet. Weyerhaeuser Company land.				

Seq. No.	County	BSP	Region	Time Since Disturbance	Disturbance
40	Brunswick	11-8-13	I	0	C Bd

Area was just completed before inspection. Georgia Pacific land. Not planted.

41	Brunswick	138-8-3	I	2 yrs.	K P Pl

Excessive soil in windrows. Windrows on the contour have created a drainage problem. Low seedling survival.

42	Columbus	86-16-2	I	3 yrs.	H

High grade. Part of site has a new home on it. Ditching has been improved. Site well vegetated.

43	Brunswick	131-18-1	I	1 yr.	C Bd Pl

Drainage improved. Bed sloped into low area. Small area. Well grassed.

44	Transylvania	122-12-12	III	2 yrs.	K Pl

Well vegetated. Competition heavy in some areas.

45	Surry	76-4-1	II	3 yrs.	H

Erosion problem in old roads due to continuous use by trail bikes. Unused roads covered in weeds. Small stream is muddy. Runoff from sawmill yard seems to be primary source. A small impoundment in the stream is rapidly filling with silt. Some debris in water course. Classified as water course damage.

46	Surry	75-24-24	II	1 yr.	H K P

High grade. Part of area KG, windrowed, and planted in grass for pasture. The rest of the area is included in the pasture. Some erosion on old roads and skid trails due to cattle.

47	Surry	91-11-19	II	2 yrs.	H

High grade. Some erosion on farm road. Stream crossings clear and free-flowing. Area is well vegetated or grassed. Some debris is across stream, but not blocking it. Classified as water course damage.

48	Yadkin	124-24-21	II	2 yrs.	H

Heavy slash covered by honeysuckle. Slash in stream. Some sediment is evidently the result of runoff from adjacent fields and farm roads. Classified as water course damage.

49	Davie	18-3-1	II	2 yrs.	H

High grade. Area well vegetated and grassed. Some debris over stream but not blocking flow. Some erosion on skid trail leading to stream crossing. Classified as water course damage.

Seq. No.	County	BSP	Region	Time Since Disturbance	Disturbance
50	Rowan	54-6-22	II	2 yrs.	H

Skidding in stream. Debris moderate on site. Intense sprout growth. Some erosion on sawmill site. Classified as water course damage.

51	Wake	38-19-16	II	2 yrs.	H

Some debris in stream. Skid trails through stream have some erosion. Area is covered by an adequate combination of grass and vines. Some roads are still subject to light erosion. Classified as water course damage.

52	Wake	16-12-7	II	2 yrs.	H

High grade. Area not visible from Highway 70 in summer. Area well vegetated with grass and vines. Some debris in stream. Skid trail across stream is well healed. Some compaction in low areas. Classified as water course damage.

53	Iredell	39-8-18	II	1 yr.	H

High grade. Debris heavy. Old inactive gullies on site. Some erosion on roads leading to site and fields. Area covered by vines, slash and residual debris. Area filters sediment from fields.

KEY

H - Harvested
K - KG bladed
T - Straight bladed
P - Piled or windrowed
Pl - Planted
DS - Direct seeded
V - V-bladed
B - Burned
C - Chopped
Bd - Bedded
F - Fertilized
BSP- Block, square and point map coordinates